

The Mars Dust and Water Cycles: Investigating the Influence of Clouds on the Vertical Distribution and Meridional Transport of Dust and Water.

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The dust and water cycles are critical to the current Martian climate, and they interact with each other through cloud formation. Dust modulates the thermal structure of the atmosphere and thus greatly influences atmospheric circulation. Clouds provide radiative forcing and control the net hemispheric transport of water through the alteration of the vertical distributions of water and dust. Recent advancements in the quality and sophistication of both climate models and observations enable an increased understanding of how the coupling between the dust and water cycles (through cloud formation) impacts the dust and water cycles. We focus here on the effects of clouds on the vertical distributions of dust and water and how those vertical distributions control the net meridional transport of water. We utilize observations of temperature, dust and water ice from the Mars Climate Sounder (MCS) on the Mars Reconnaissance Orbiter (MRO) and the NASA ARC Mars Global Climate Model (MGCM) to show that the magnitude and nature of the hemispheric exchange of water during NH summer is sensitive to the vertical structure of the simulated aphelion cloud belt. Further, we investigate how clouds influence atmospheric temperatures and thus the vertical structure of the cloud belt. Our goal is to isolate and understand the importance of radiative/dynamic feedbacks due to the physical processes involved with cloud formation and evolution on the current climate of Mars.